Some Polyclad Flatworms from the Hawaiian Islands

Libbie H. Hyman[1]

One may suppose that a rich polyclad fauna exists along the shores of the Hawaiian Islands, but our knowledge of Hawaiian polyclads is, in fact, very limited. As far as I can ascertain, only the following species are recorded from the Hawaiian Islands in the literature: *Planocera hawaiiensis* Heath, 1907; *Taenioplana teredini* Hyman, 1944; and *Stylochoplana inquilina* Hyman, 1950. The first merits further examination, but the specimens cannot be located. Three further species from Hawaii have been received for identification, from the United States National Museum, and furnish the material for the present article, which thus adds something to our small knowledge of the polyclad fauna of these islands. All three species belong to the Acotylea and to the section Schematommata. As the taxonomic categories that concern these three species have been carefully defined in a recent publication (Hyman, 1953*a*), there appears no need for repetition of these definitions here.

Family *LEPTOPLANIDAE*

Euplana tropicalis n. sp.
Fig. 1

The species is based on one specimen that was collected near Kapoho, Hawaii, September 25, 1929. The species is rather large, of elongated oval form, 38 millimeters long by 17 millimeters wide (Fig. 1*a*), but, as it is evidently contracted, it presumably reaches a much greater length. The specimen had acquired the usual dark-brown color typical of museum specimens but in life was probably tan with dark-brown spots. The tentacular eyes form small but conspicuous clusters of about 10 eyes on one side and 15 on the other, but the cerebral eyes could not be made out satisfactorily. They appeared to be very few in number and were seen chiefly on one side. The form of the pharynx as far as seen and the locations of mouth and gonopores appear in Figure 1*a*.

The posterior half was removed and the region of the copulatory complexes sectioned sagittally. The histological condition is poor, but the parts of the complexes were followed satisfactorily and are represented in schematic sagittal view in Figure 1*b*. Both complexes appear unusually sinuous, much more so than as represented in the figure, but whether this is natural or the result of the contraction of the specimen is uncertain. The complexes occur shortly behind the pharynx as is usual in the Leptoplanidae. The gonopores are widely separated. The male gonopore leads into a somewhat expanded male antrum lined with a sinuous epithelium and bearing at its inner end a small penis sheath. From this a long penis pocket proceeds anteriorly, sur-

[1] American Museum of Natural History. Manuscript received June 19, 1953.

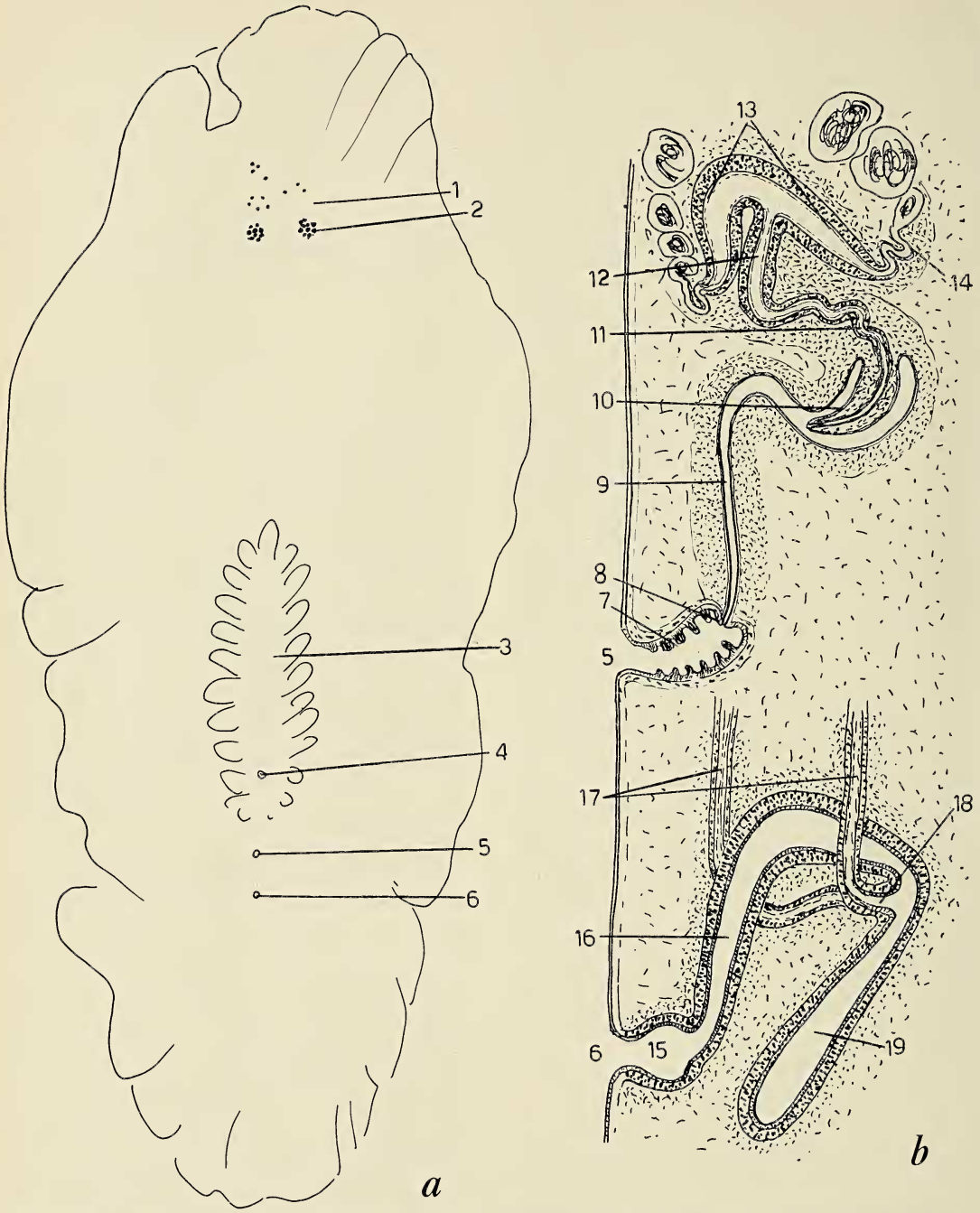

FIG. 1. *Euplana tropicalis*. *a*, Entire specimen; *b*, sagittal view of the copulatory complexes from sections. 1, Cerebral eyes; 2, tentacular eyes; 3, pharynx; 4, mouth; 5, male gonopore; 6, female gonopore; 7, male antrum; 8, penis sheath; 9, penis pocket; 10, penis papilla; 11, ejaculatory duct; 12, seminal vesicle; 13, horns of seminal vesicle or spermiducal bulbs; 14, sperm duct; 15, female antrum; 16, vagina; 17, uteri; 18, entrance of oviduct into vagina; 19, Lang's vesicle.

rounded by dense mesenchyme, and after bending dorsally terminates in a slightly expanded chamber housing the elongated, conical penis papilla. The central duct of the papilla, or ejaculatory duct, proceeds forward and downward very sinuously and becomes continuous with the central part of a tripartite seminal vesicle. This has pronounced muscular walls of chiefly circular fibers. It is very peculiar in that one horn of this tripartite structure descends ventrally, receiving one sperm duct, and the other ascends dorsally, receiving the other sperm duct. This lack of bilateral symmetry in the entry of the sperm ducts into the seminal vesicle is certainly very unusual. Possibly the two horns of the tripartite seminal vesicle should be regarded as spermiducal bulbs, that is, as thickened terminations of the sperm ducts.

The female gonopore leads into a short, expanded antrum from which the vagina proceeds forward and then dorsally in a very sinuous manner, not indicated in the figure. Shortly after bending from a vertical to a horizontal position, the vagina receives the common oviduct and then continues as an oval Lang's vesicle. The female tract throughout has a well-developed muscular coat of mainly circular fibers. The same peculiar asymmetry seen in the entry of the sperm ducts into the male apparatus also obtains in the entry of the oviducts into the vagina. As shown in Figure 1*b*, one oviduct is situated ventrally, the other dorsally. Cement glands were not evident, no doubt because of the poor histological condition. The uteri also could not be traced anteriorly.

A penis papilla at the inner end of a long male antrum guarded distally by a penis sheath also characterizes two other species of *Euplana—concolor* Meixner, 1907, and *clippertoni* Hyman, 1939. However, a penis stylet is present in the latter, and the Lang's vesicle is very small in the former. Further, no other species of *Euplana* has the peculiar asymmetry of the sperm ducts and the oviducts that distinguishes *E. tropicalis*.

The holotype has been deposited in the United States National Museum in the form of slides bearing the anterior half mounted whole and the copulatory complexes as sagittal serial sections.

Family *PLANOCERIDAE*

Paraplanocera oligoglena (Schmarda) 1859

One specimen of this species, collected by H. W. Henshaw at Hilo, Hawaii (no date), was sent as a whole mount. The specimen was much ruffled, measuring 33 millimeters in length by 28 millimeters in breadth. The features of the copulatory apparatuses, including the two large teeth at right angles to each other in the cirrus sac, were readily seen in the whole mount and considered to establish the identification without the necessity of sections. This species is cosmopolitan in tropical and subtropical waters and has been recorded from a number of localities in the Indo-Pacific region, further from the Gulf of California (Hyman, 1953*a:* 353–357). The whole mount has been returned to the U. S. National Museum.

Planocera pacifica n. sp.

Figs. 2, 3

A fine, perfect specimen was taken in the Hawaiian Islands by P. S. Galtsoff, July 27, 1930, in the evening, hence presumably swimming at the surface. The specimen (Fig. 2) is of broadly oval form, with ruffled margins, 40 millimeters long by 25 millimeters wide. The color is indeterminable, but the worm appears thin and transparent. There is a pair of conspicuous conical tentacles near the brain, far back from the anterior margin. A ring of tentacular eyes occurs at the base of each tentacle. The fairly numerous, small cerebral eyes (Fig. 3*a*) are more abundant anterior to than behind the brain level. The broad, ruffled pharynx with about six main lateral folds on each side occupies approximately the central region of the worm (Fig. 2), and di-

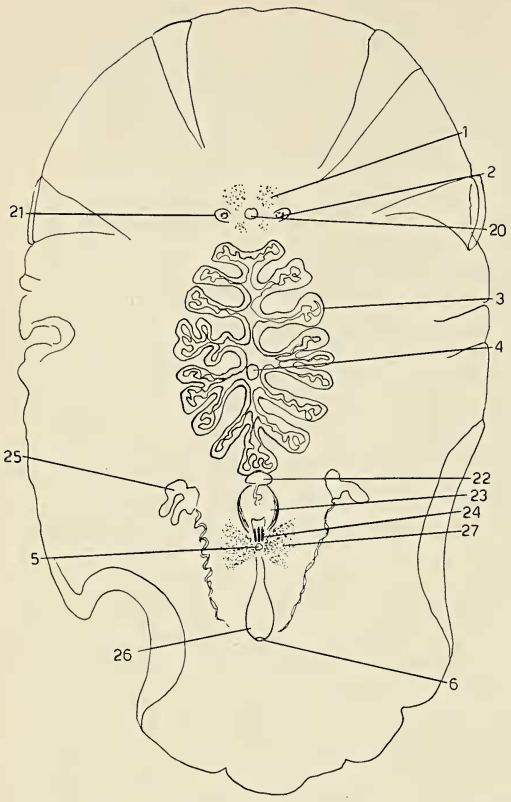

FIG. 2. *Planocera pacifica*, entire specimen. 1, Cerebral eyes; 2, tentacular eyes; 3, pharynx; 4, mouth; 5, male gonopore; 6, female gonopore; 20, brain; 21, tentacles; 22, prostatic vesicle; 23, cirrus sac; 24, large teeth of cirrus sac; 25, uterine sac; 26, bulbous antrum; 27, cement glands.

rectly behind it is seen the male copulatory apparatus, armed near the male gonopore with three large teeth. Behind this is seen the bulbous termination of the female copulatory apparatus. To either side of the male apparatus there occurs a sacciform enlargement of the uterus, presumably for the purpose of storing eggs. Such sacs are unusual in acotylean polyclads. The details of the copulatory apparatuses, insofar as they could be seen in the cleared whole specimen, are shown in Figure 3*b*.

For species discrimination, it was considered necessary to remove the copulatory region of the worm and section it sagittally. A view of the copulatory complexes as constructed from the series of sagittal sections is given in Figure 3*c*. At the anterior end of the male apparatus is seen the elongated, curved seminal vesicle closely applied to the ventral wall of the prostatic vesicle. The common sperm duct enters the ventral surface of the seminal vesicle, passes slantingly and upward in the muscular wall of this vesicle, then turns back and becomes the lumen of the vesicle. It enters the proximal end of the cirrus sac in contact with the prostatic duct. The prostatic vesicle is a slightly oval sac situated at the anterior end of the cirrus sac but not bound with the latter in its muscular sheath. The prostatic vesicle has a thin muscular wall, and the interior is filled as usual with a much-folded, glandular eosinophilous lining. The short prostatic duct and the duct of the seminal vesicle enter the anterior end of the cirrus sac in contact with each other and terminate in the beginning of the ejaculatory duct. The cirrus sac is a large oval body with a thick muscular wall distally, a thinner wall proximally. This proximal half of the cirrus sac is filled with a loose tissue traversed by diagonal muscle fibers and contains the slightly sinuous ejaculatory duct. This opens on a projection into what is presumably the lumen of the cirrus sac. This is widened anteriorly around the projection in question, then narrows to a tube running to the male gonopore. The lumen of the cirrus sac is lined by small teeth that increase in size distally. At the distal end of the cirrus lumen, where it opens into the male gonopore, are the three large teeth already mentioned. One of these and part of another appear in Figure 3*c*.

The female gonopore occurs some distance behind the male pore and leads into an antrum with excessively thick muscular walls, composed of circular and radiating fibers intermingled. This muscular antrum, or bulbous vagina as it is termed by some, extends anteriorly, gradually narrowing until it reaches nearly the level of the male gonopore. It then narrows abruptly into the vagina which turns first backward and then forward again, run-

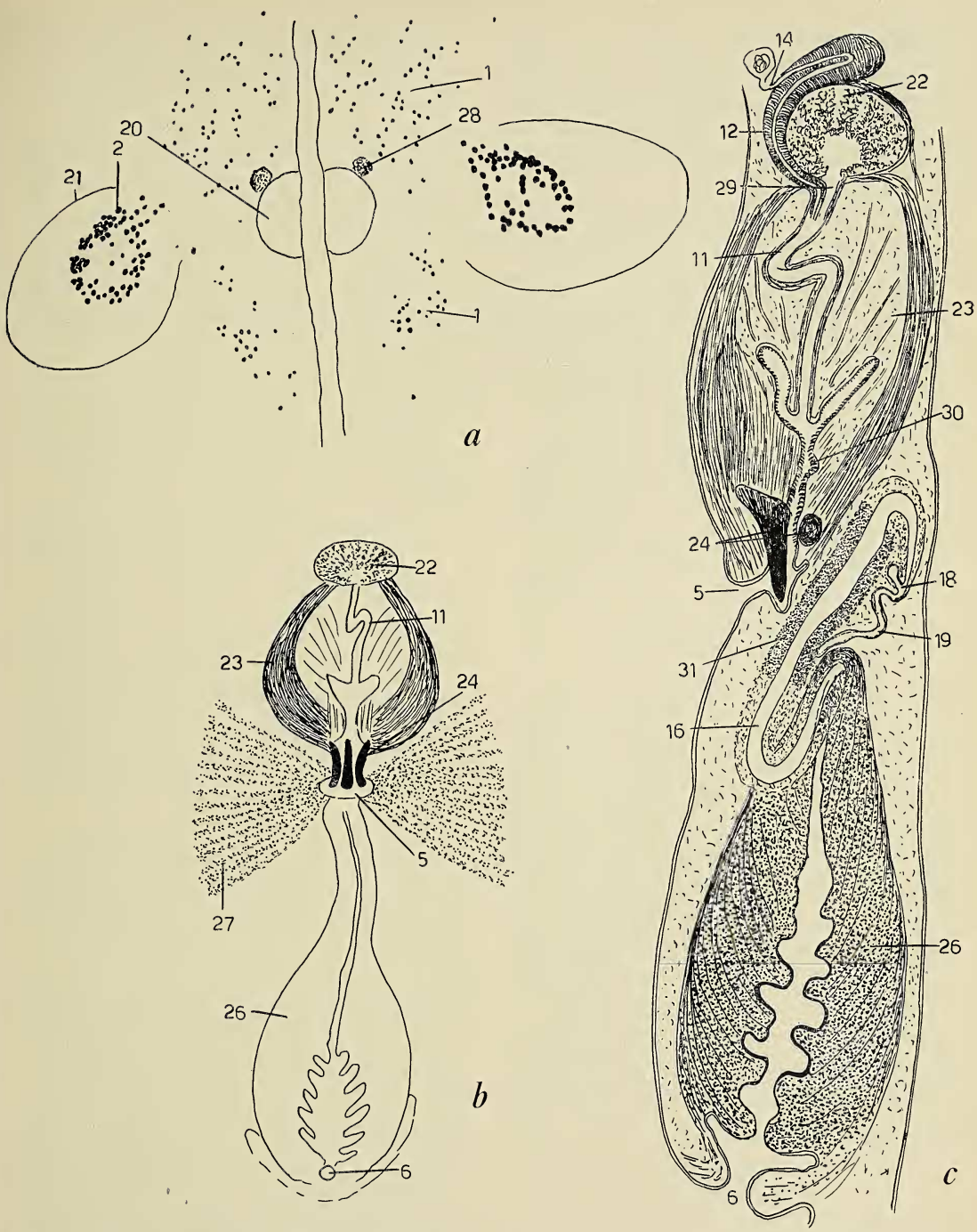

FIG. 3. *Planocera pacifica*. *a*, Enlarged view of eyes and tentacles; *b*, copulatory complexes seen from above in cleared entire specimen; *c*, sagittal view of the copulatory complexes from sections. 1, Cerebral eyes; 2, tentacular eyes; 5, male gonopore; 6, female gonopore; 11, ejaculatory duct; 12, seminal vesicle; 14, sperm duct; 16, vagina; 18, entrance of oviduct into vagina; 19, Lang's vesicle; 20, brain; 21, tentacles; 22, prostatic vesicle; 23, cirrus sac; 24, large teeth of cirrus sac; 26, bulbous antrum; 27, cement glands; 28, granule masses of brain; 29, prostatic duct; 30, small teeth lining lumen of cirrus sac; 31, cement glands entering vagina.

ning just above the distal part of the cirrus sac. Along much of this course it is heavily supplied with cement glands. It then turns backward, narrowing as it receives the common oviduct; beyond this it continues for a short distance as a narrow, tubular, somewhat sinuous Lang's vesicle.

Until recently but one species of *Planocera* with three large teeth in the distal end of the cirrus sac was known, namely, *P. crosslandi* Laidlaw (1903: 100), from the coast of British East Africa. Laidlaw gave a good description of this but did not furnish any figures. Recently Prudhoe (1952: 175) assigned a specimen from the Gulf of Aqaba, Red Sea, to *P. crosslandi* on the basis of the presence of three large cirrus spines but did not section the worm. I recently studied a *Planocera* from the Galápagos Islands with three large teeth in the distal end of the cirrus sac and decided it was not identical with *P. crosslandi*, naming it *tridentata* (Hyman, 1953*b:* 188). Both *tridentata* and *pacifica* differ from *crosslandi* in that the prostatic vesicle is not bound in common with the cirrus sac in the same muscular sheath. Further, *tridentata* lacks a Lang's vesicle, having instead a very long and narrow vagina recurved on itself, whereas *crosslandi* is described as having a long, thread-like Lang's vesicle, and in *pacifica* Lang's vesicle is short and tubular. It may be concluded that there are several species of *Planocera* armed with three large teeth at the exit of the cirrus sac and that the presence of these teeth is not a sufficient basis for species identification.

The holotype, preserved in alcohol, has been deposited in the U. S. National Museum, accompanied by the slides of sections of the removed copulatory region.

REFERENCES

Heath, Harold. 1907. A new turbellarian from Hawaii. *Acad. Nat. Sci. Phila., Proc.* 59: 145–149, 1 pl.

Hyman, Libbie H. 1939. Polyclad worms collected on the Presidential Cruise of 1938. *Smithsn. Inst., Misc. Collect.* 98(17): 1–13, 15 figs.

——— 1944. A new Hawaiian polyclad associated with Teredo. *Bernice P. Bishop Mus., Occas. Papers* 18 (4): 73–75, 1 fig.

——— 1950. A new Hawaiian polyclad, *Stylochoplana inquilina*, with commensal habits. *Bernice P. Bishop Mus., Occas. Papers* 20 (4): 55–58.

——— 1953*a*. The polyclad flatworms of the Pacific coast of North America. *Amer. Mus. Nat. Hist., Bul.* 100 (art. 2): 269–392, 161 figs.

——— 1953*b*. Some polyclad flatworms from the Galápagos Islands. *Allan Hancock Pacific Exped.* 15(12): 183–210, 14 figs.

Laidlaw, Frank F. 1903. On the marine fauna of Zanzibar and British East Africa, from collections made by Cyril Crossland in the years 1901 and 1902. Turbellaria Polycladida. Part I. The Acotylea. *Zool. Soc. London, Proc.* 1903: 99–113, 7 text figs., 1 pl.

Meixner, A. 1907. Polycladen von der Somaliküste, nebst einer Revision der Stylochinen. *Ztschr. f. Wiss. Zool.* 88: 385–498, 2 text figs., 5 pls.

Prudhoe, Stephen. 1952. Manihine Expedition to the Gulf of Aqaba, 1948–1949. IV. Turbellaria: Polycladida. *Brit. Mus. (Nat. Hist.), Bul., Zool.* 1 (8): 175–179, 2 figs.

Schmarda, Ludwig. 1859. *Neue wirbellose Thiere beobachtet und gesammelt auf einer Reise um die Erde 1853 bis 1857*. Erster Band. Turbellarien, Rotatorien und Anneliden. Erste Hälfte. xviii+66 pp., 15 pls. Wilhelm Engelman, Leipzig.